



2015 Water Quality Report
Fresh Pond Reservation: Class B Ponds, Cambridge, MA

The Cambridge Water Department monitors three ponds on the Fresh Pond Reservation: Little Fresh Pond, Black's Nook, and North Pond. These shallow ponds have no surface water connections to the Fresh Pond water supply reservoir, and as such, they have negligible influence over water quality in the Cambridge water supply. Gated pipes between Little Fresh Pond and Fresh Pond Reservoir are kept closed under normal operating conditions, but are opened as needed in controlled conditions to supply irrigation water to Little Fresh Pond. All three ponds drain the City of Cambridge Municipal Golf Course and the reservation's wooded areas, with overflow connections to the City's storm drain system. Stormwater in the developed areas surrounding the reservation is diverted away to further protect drinking water quality. Groundwater communication between the ponds, the surrounding developed area, and the reservoir is minimized by keeping the reservoir higher than the water table. This report includes data collected from April 1, 2015 to March 31, 2016.

Figure 1: Fresh Pond Reservation Waterbodies





2015 Fresh Pond Reservation Class B Waters

Massachusetts Class B waters are designated for fish, other aquatic life and wildlife habitat, and for primary and secondary contact recreation. Class B water quality standards include numeric and narrative standards for dissolved oxygen, temperature, pH, bacteria, solids, color and turbidity, oil and grease, and taste and odor. In this study period, five dry-weather water quality sampling events were conducted. Samples were taken at the surface of each pond using extended poles or hand-grabbing samples after wading in from the shoreline. In-situ parameters were taken with a calibrated multi-probe concurrently with grab samples.

2015 Results

Black's Nook- Listed in 2008 Massachusetts Integrated List of Waters as a Category 5 impaired water for nutrients and noxious plants. Historic and recent chlorophyll-*a* and total phosphorus results are consistent with Carlson's trophic state index (TSI) of a highly-productive, eutrophic pond. Median and average TSI numbers during this period were in the eutrophic range (figure 2).

1. Dissolved Oxygen

- There were two violations of the Class B standard for dissolved oxygen (≥ 5 mg/L) observed in surface samples during the reporting period.

7/21/15	4.79 mg/L
8/27/15	3.64 mg/L

2. Temperature

- No violations associated with warm-water fisheries were observed. Class B standard requires temperatures not to exceed 28.3°C.

3. pH

- No violations observed; $6.5 < \text{pH} < 8.3$.

4. Bacteria

- No violations observed. *E. coli* standard is < 235 colonies/100mL for a single sample, and geometric mean of grouped samples < 126 col/100mL.

5. Solids

- There are no numeric criteria for solids, but visual observations suggest that neither floating nor suspended solids were an impairment for Black's Nook.



2015 Fresh Pond Reservation Class B Waters

6. Color and Turbidity

- There are no numeric criteria for color and turbidity, however the standard dictates water bodies must be free from aesthetically objectionable conditions. Eutrophic state and water clarity discourage swimming and boating.

7. Taste and Odor

- No objectionable odors observed.

8. Oil and Grease

- No samples taken, but no visible sheens observed.

Little Fresh Pond- Not assessed as part of the Massachusetts Integrated List of Waters survey. Chlorophyll-*a* and total phosphorus results are consistent with Carlson's trophic state index of a highly-productive, eutrophic pond (figure 2). Shoreline restoration, vegetated buffers, and a pretreatment swale and forebay system were completed in 2008. Specific conductance readings, sodium concentration and chloride concentrations are consistently among the highest of the reservation ponds. The values for these parameters closely mirror those of Fresh Pond Reservoir, reflecting the hydrological connectivity via pipes and groundwater communication (table 1). Dissolved Oxygen

- There was one violation of the Class B standard for dissolved oxygen observed during the 8/27/2015 sampling event (4.65 mg/L).

2. Temperature

- No violations associated with warm-water fisheries were observed; $T \leq 28.3^{\circ}\text{C}$.

3. pH

- No violations observed; $6.5 < \text{pH} < 8.3$.

4. Bacteria

- No violations observed.



2015 Fresh Pond Reservation Class B Waters

5. Solids

- Visual observations suggest that neither floating nor suspended solids were an impairment in the pond.

6. Color and Turbidity

- There are no numeric criteria for color and turbidity, however the standard dictates water bodies must be free from aesthetically objectionable conditions. Eutrophic state and water clarity discourage swimming and boating.

7. Taste and Odor

- No objectionable odors observed.

8. Oil and Grease

- No samples taken, but no visible sheens observed.

North Pond- Not assessed as part of the Massachusetts Integrated List of Waters survey. During the growing season, this pond is filled with floating and rooted aquatic plants. Median and average Chlorophyll-*a* and total phosphorus results are consistent with Carlson's trophic state index of a highly-productive, eutrophic pond (figure 2).

1. Dissolved Oxygen

- There were two violations of the Class B standard for dissolved oxygen observed during the reporting period on 7/21 and 8/27.

7/21/15	3.13 mg/L
8/27/15	4.66 mg/L

2. Temperature

- No violations associated with warm-water fisheries were observed $T \leq 28.3$ C.

3. pH

- No violations observed. $6.5 < \text{pH} < 8.3$.

4. Bacteria

- No violations observed.

5. Solids



2015 Fresh Pond Reservation Class B Waters

- There are no numeric standards for solids, but visual observations suggest that neither floating nor suspended solids are a source of impairment for the pond.

6. Color and Turbidity

- Eutrophic state and water clarity discourage swimming and boating; during the summer, North Pond becomes choked with aquatic vegetation.

7. Taste and Odor

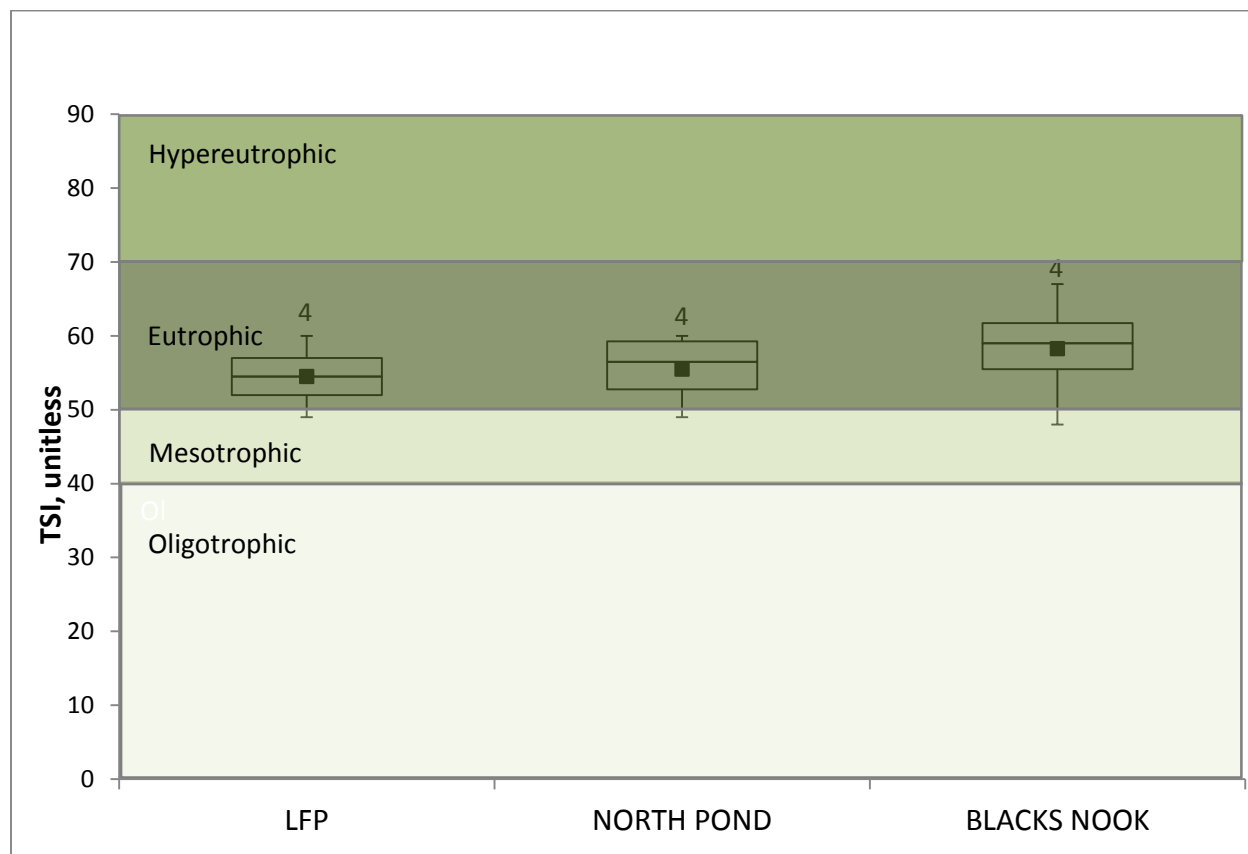
- No objectionable odors observed.

8. Oil and Grease

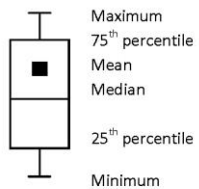
- No samples taken, but no visible sheens observed.



Figure 2: Reservation Pond Trophic State Index from Chlorophyll-*a*, 2015



(3) Number of Measurements





2015 Fresh Pond Reservation Class B Waters

Table 1: Water Quality Results

Site	Date	Time	Water temp. (°C)	SpC (µS/cm)	DO (%Saturation)	DO (mg/L)	pH	Orp mV	Salinity (PSS)	TDS (mg/L)	Air temp. (°F)	BP (mmHg)	Water level	Comments
Black's Nook	5/11/2015	10:42:58	23.8	153.2	89.6	7.6	7.44	137	0.07	98	74.84	763		
Black's Nook	7/21/2015	10:03:32	26.1	137.4	59.9	4.79	7.72	149	0.06	87.9	76.46	752		Sampled using waders several feet from dock. Site relatively free of aquatic vegetation
Black's Nook	8/27/2015	10:15:43	22.78	154.1	42.3	3.64	6.87	144	0.07	98.6	71.78	760	low	Sampled a few feet from dock
Black's Nook	12/7/2015	9:52:23	4.69	188.92	91.5	11.84	7.53	95.36	0.08	NS	42.62	764.2	Mid-low	Using borrowed probe, so no TDS
Black's Nook	3/1/2016	10:37:02	6.33	171.6	94.6	11.75	7.55	148.3	0.08	109.8	37.76	765.5	Mid	Lots of waterfowl
North Pond	5/11/2015	10:16:05	25.78	279.2	97.5	7.97	7.5	116	0.13	178.7	78.41	763		
North Pond	7/21/2015	9:37:44	24.61	231.2	38.1	3.13	7.41	63	0.11	148	75.92	752	NS	Covered with aquatic vegetation-likely coon's tail. Barely any open water
North Pond	8/27/2015	9:52:36	25.45	259	57	4.66	6.82	51	0.12	165.7	71.42	760	NS	Covered with aquatic vegetation-likely coon's tail.
North Pond	12/7/2015	10:33:41	4.04	299.2	62.1	8.18	7.23	68.14	0.14	NS	44.06	764.2	NS	Thin sheet of ice on surface. Borrowed probe used, so TDS not sampled
North Pond	3/1/2016	11:10:16	6.68	268.5	49.9	6.14	7.25	95.1	0.12	171.8	37.22	765.5	NS	
Little Fresh Pond	5/11/2015	9:48:43	23.76	681.6	94.5	8.01	7.49	115	0.33	436.2	74.77	763	Low	Shoreline grab, water level pretty low
Little Fresh Pond	7/21/2015	9:16:37	26.91	714.7	78	6.15	7.09	157	0.34	457.4	74.48	752	Low	Lower than gage, 15.8
Little Fresh Pond	8/27/2015	9:28:25	25.26	768.2	56.7	4.65	6.77	151	0.37	491.7	69.44	760	Low	Water level below gage still, 15.8; Dechlorinated water from Payson pumped to LFP during the past week due to cleaning operations
Little Fresh Pond	12/7/2015	10:59:36	5.43	661.92	79	10.01	7.4	158.88	0.32	NS	44.96	764.2	Mid	Algae on surface-several feet in width along the Northwestern shoreline. Mostly Uroglenopsis and Pediatrum
Little Fresh Pond	3/1/2016	10:11:19	6.95	471.8	94.7	11.58	7.77	113.1	0.22	302	35.96	765.5	16.6	



2015 Fresh Pond Reservation Class B Waters

Table 1: Water Quality Results cont.

Site	Date	Time	NH3 Ammonia (mg/L)	TKN (mg/L)	Total Phos. (mg/L)	Chlorophyll (mg/m3)	lab number	Ca (mg/L)	Cl (mg/L)	Color (CU)	Lab Conductivity (umhos/cm)	E-coli (MPN)	Mn (mg/L)
Black's Nook	5/11/2015	10:42:58	<0.050	0.65	0.031	5.67	2015-1752	14.3	15.6	16	160	16	0.056
Black's Nook	7/21/2015	10:03:32	0.155	0.8	0.0605	39.15	15072102-01	14.05	13.75	22	124.5	208.5	0.053
Black's Nook	8/27/2015	10:15:43	0.06	1	0.086	15.60	15082703-01	15.6	15.9	24	151	26.5	0.028
Black's Nook	12/7/2015	9:52:23	0.14	0.58	0.029	20.00	15120702-01	16.5	24	19	161	17	0.056
Black's Nook	3/1/2016	10:37:02	<0.050	0.48	0.044	26.10	16030102-01	16.2	21.7	26	149	1	0.048
North Pond	5/11/2015	10:16:05	0.0705	0.69	0.0285	6.37	2015-1753	34.7	17.75	33	294.5	2.5	0.0875
North Pond	7/21/2015	9:37:44	0.17	1.3	0.064	17.6	15072102-03	33.90	18	72	205	60	0.65
North Pond	8/27/2015	9:52:36	0.2	3	0.22	20.8	15082703-03	26	178	136	749	8.1	0.672
North Pond	12/7/2015	10:33:41	0.195	0.835	0.0305	10.675	15120702-03	32.75	29.65	50.5	267	9.5	0.1275
North Pond	3/1/2016	11:10:16	0.1	1.3	0.14	82	16030102-03	31.6	24.8	200	226	13	0.947
Little Fresh Pond	5/11/2015	9:48:43	0.14	0.88	0.063	6.47	2015-1751	38	161	19	741	1	0.289
Little Fresh Pond	7/21/2015	9:16:37	0.068	1	0.022	10.2	15072102-02	38.8	164	31	647	40	0.209
Little Fresh Pond	8/27/2015	9:28:25	0.074	0.715	0.049	19.8	15082703-02	35.35	174.5	39.5	747	5.2	0.4925
Little Fresh Pond	12/7/2015	10:59:36	0.33	0.97	0.033	12.7	15120702-02	30.5	170	29	554	<1	0.169
Little Fresh Pond	3/1/2016	10:11:19	0.094	0.67	0.04	19.6	16030102-02	23.5	108	27	421	<1	0.1

*Green= Results averaged with Field Duplicate



2015 Fresh Pond Reservation Class B Waters

Table 1: Water Quality Results cont.

Site	Date	Time	NO3 (mg/L)	NO2 (mg/L)	Lab pH	Na (mg/L)	TOC (mg/L)	Alkalinity (mg/L CaCO3)	Al (mg/L)	Total coliform (MPN)	Fe (mg/L)	lab turbidity (ntu)	UV254 (abs)
Black's Nook	5/11/2015	10:42:58	<0.005	<0.004	7.62	7.97	5.1	49	0.006	1000	0.289	1.07	0.119
Black's Nook	7/21/2015	10:03:32	<0.005	<0.050	7.98	8.41	6.75	43.75	0.05	2420	0.4875	1.73	0.154
Black's Nook	8/27/2015	10:15:43	<0.005	<0.005	7.27	9.19	6.7	47.5	0.09	>2419.6	0.679	1.6	0.159
Black's Nook	12/7/2015	9:52:23	<0.050		7.18	10.7	5.2	51.5	0.00487	201	0.548	2.67	0.116
Black's Nook	3/1/2016	10:37:02	<0.005	<0.005	7.47	10.1	5	48.5	0.01524	101	0.955	2.87	0.14
North Pond	5/11/2015	10:16:05	0.0135	<0.004	7.8	10.9	8.3	110.5	0.016	645	0.798	2.675	0.2395
North Pond	7/21/2015	9:37:44	0.056	<0.010	8.44	14.20	9.9	82	0.027	2420	3.82	5.69	0.378
North Pond	8/27/2015	9:52:36	<0.005	<0.005	7.41	15.2	11	82	1.99	>2419.6	9.34	19.1	0.514
North Pond	12/7/2015	10:33:41	<0.050		7.185	14.5	11.3	102	0.01523	120.5	1.44	5.075	0.3285
North Pond	3/1/2016	11:10:16	<0.005	<0.005	6.85	12.9	11.7	96.5	0.06354	248	10	23	0.737
Little Fresh Pond	5/11/2015	9:48:43	0.13	<0.004	7.86	104	3.8	56	0.056	150	0.771	2.39	0.112
Little Fresh Pond	7/21/2015	9:16:37	<0.005	<0.005	7.34	99.3	3.4	67.5	0.03	2420	0.941	3.77	0.138
Little Fresh Pond	8/27/2015	9:28:25	<0.005	<0.005	7.235	117	4.6	63.5	0.043	>2419.6	1.695	4.765	0.153
Little Fresh Pond	12/7/2015	10:59:36	<0.050		7.3	84.3	5.3	52.5	0.02793	30	0.748	3.83	0.136
Little Fresh Pond	3/1/2016	10:11:19	0.02	0.01	7.58	50.4	4.4	51.5	0.0936	80	0.724	2.77	0.12

*Green= Results averaged with Field Duplicate